

3.0 HAZARD ASSESSMENT

3.1 HAZARD ASSESSMENT INTRODUCTION

3.1.1 Purpose

The Hazard Assessment portion of this document provides a detailed description of the hazards in Montana, an assessment of the State's vulnerability to those hazards, and a basis for the mitigation goals and activities proposed in the Mitigation Strategy portion of the document. This Hazard Assessment section examines natural and man-made hazards that can impact the state, determines which areas of the state are most vulnerable to each hazard, and estimates potential losses to state facilities for each hazard. This assessment is both a stand-alone product (referred to as the Statewide Hazard Assessment) and part of the State of Montana Multi-Hazard Mitigation Plan and Statewide Hazard Assessment.

The *State of Montana Hazard Assessment* identifies and describes the major natural and man-made hazards that have the greatest potential to affect the people, environment, economy, and property of the state. These hazards are:

- Earthquakes
- Flooding
- Hazardous Material Incidents
- Landslide
- Terrorism and Violence
- Volcanic Eruptions
- Winter Storms and Avalanche
- Drought and Effects of Drought
- Severe Thunderstorms, Hail, Wind and Tornadoes
- Wildland and Rangeland Fires

This Hazard Assessment describes each of the above-listed 10 hazard categories, including a history of impacts to the state and a profile of declared disasters, emergency orders, and Federal assistance. Where possible, the hazard assessment identifies jurisdictions most vulnerable to future hazard events, and provides a synopsis of State-owned and operated facilities and infrastructure that are most likely at-risk to the hazard. The results of this Hazard Assessment were used to formulate the mitigation strategies outlined.

The Hazard Assessment makes reference to Pre-Disaster Mitigation Plans completed for local jurisdictions (i.e., Local PDM Plans). Local PDM Plans are a key to understanding the local impacts from hazards within a city, county, or Indian reservation. At this time, only a handful of Local PDM Plans have been completed and approved. As more Local PDM Plans are completed, the Hazard Assessment will be updated to provide more accurately identify local impacts from the hazards profiled herein.

3.1.2 Hazard Identification and Document Preparation

3.1.2.1 Identifying Hazards

The hazards addressed in this assessment were identified through a series of Hazard Technical Advisory Group and Stakeholder Meetings, which included statewide experts in resource management, emergency services and disaster mitigation (see Section 7.1 and 7.2 for a listing of members/participants). Review of the previous *State of Montana Hazard Mitigation Plan* helped form a framework for the discussions and the identification of hazards.

3.1.2.2 Profiling Hazards

Each hazard was profiled by identifying the characteristics of the hazard, highlighting the recorded history of the hazard in Montana, and citing disaster declarations at the State and Federal level. The intent was to provide sufficient background to assess the potential for hazard recurrence and vulnerability in different portions of the state.

Individual hazard profiles begin with a description of the hazard, highlighting particular characteristics of the hazard. Sources for hazard information included:

- State of Montana Hazard Mitigation Plans (1996 and 1998).
- Historical disaster records and documents, including but not limited to reports and spreadsheets maintained by the Montana Disaster and Emergency Services (MDES).
- Government publications and web-sites regarding historic hazards and predicted hazard areas.
- Written and oral communication with state and national hazard experts.
- Facility databases developed by State agencies participating in the development of this plan.

Following each hazard profile is a list of references for that particular hazard (earthquake, flood, etc.).

Significant disasters are also described in detail to provide examples on the extent of the impact(s) from a disaster(s). Some of the more significant disasters include the Hebgen Dam earthquake in 1959, the Helena earthquake in 1935, the Great Flood in Great Falls in 1964, the Great Idaho (and Montana) wildfire in 1910, and the Ravalli County wildfires in 2000. Each hazard profile includes a discussion of any Presidentially-Declared Disasters.

3.1.2.3 Disaster Declarations

Disasters can take many shapes and forms, and therefore, many different organizations are tasked with disaster assistance. From private organizations such as the American Red Cross, to Federal agencies such as the Federal Emergency Management Agency (FEMA), to State emergency management offices, each have their own purpose and tasks during times of disaster. As a result, what may be termed a disaster by one organization, may not be for another. In an attempt to clarify some of the disaster declarations mentioned in the hazard assessment, the most common types of disaster declarations and assistance have been identified.

Presidential Major Disaster Declaration: The most significant natural and manmade disasters overwhelming the affected state and local governments are declared by the President of the United States through a request made by the respective Governor(s). These requests are typically handled by FEMA. The assistance provided is done so under the Robert T. Stafford Disaster Relief and Emergency Assistance Act 42 U.S.C. §§ 5121-5206. Presidential Declared Disasters can be limited to certain categories of assistance and specific geographical areas (typically counties or reservations). The types of assistance provided by FEMA under a Presidential Declared Disaster are listed below.

Individual Assistance (IA):

Individual Assistance primarily involves disaster recovery for individuals. The forms of assistance typically available include low-interest loans for homeowners or businesses, cash grants, temporary housing, veteran benefits, tax refunds, excise tax relief, unemployment benefits, crisis counseling, and legal counseling.

Public Assistance (PA):

Public Assistance provides for the recovery of government infrastructure and services. This program typically funds the repair, restoration, reconstruction, or replacement of a public facility or infrastructure damaged or destroyed by a disaster and other items such as debris removal and emergency protective measures.

Hazard Mitigation Assistance:

Hazard Mitigation Assistance, through the Hazard Mitigation Grant Program and others, funds measures designed to reduce future losses to public and private property. This assistance is managed by the State and is available to all communities in the state, not just those affected.

Federal Emergency Declaration: An Emergency Declaration is more limited in scope than a major disaster declaration and does not provide the long-term Federal recovery programs. Generally, Federal assistance and funding are provided to meet a specific emergency need, such as snow plowing, or to help prevent a major disaster from occurring.

Fire Management Assistance Declaration: A Fire Management Assistance Declaration, formerly known as a fire suppression assistance declaration, allows for assistance when a fire or fire complex threatens such destruction as would constitute a major disaster. This program is also managed by FEMA.

State Disaster Declaration: A State Disaster Declaration is similar to a Presidential Disaster Declaration, but at the State level and declared by the Governor. State Disasters are typically declared when a disaster overwhelms the resources of the local government. The State declaration is a necessary precursor to a Presidential Disaster Declaration. In Montana, State disasters are declared through Executive Orders by the Governor.

State Emergency Declaration: A State Emergency Declaration is similar to a Federal Emergency Declaration at the State level. State Emergency Declarations allow State resources to be used in responding to or preparing for a disaster. These declarations are typically made through Executive Orders by the Governor.

State Incident Declaration: A State Incident Declaration is used in Montana when the level of an incident is elevated to the level of monitoring and response by Montana Disaster and Emergency Services (MDES). This declaration is typically done prior to an emergency or disaster declaration and activates the State Emergency Operations Center.

USDA Secretarial Disaster Designation: These disasters, typically to the agricultural community, are made by the Secretary of Agriculture and must be requested by the Governor. As with FEMA programs, USDA offers various programs for disasters.

Natural Disaster Determination: Low-interest loans are provided to primary and contiguous counties for family-sized farm operators from the Farm Service Agency (FSA).

Administrator's Physical Loss Notification: This Farm Service Agency (FSA) program provides for physical losses, such as a building destroyed by a tornado.

Quarantine Designation: This Farm Service Agency (FSA) program provides loans from losses due to a quarantine.

SBA Disaster Declarations: The Small Business Administration (SBA) can designate a disaster when at least three businesses sustain uninsured losses of 40% or more and if 25% or more of the community work force is unemployed for at least 60 days due to the disaster.

3.1.2.4 Incorporating Local Hazard Information

The State of Montana Multi-Hazard Mitigation Plan and Statewide Hazard Assessment relies heavily upon the statewide and local hazard assessments. These local hazard assessments determine the vulnerability to a particular hazard and an estimate of potential losses. The local assessments are part of Local Pre-Disaster Mitigation Plans (Local PDM Plans) being completed by jurisdictions as part of their compliance with the Disaster Mitigation Act of 2000. Since many of the Local PDM Plans are being completed during the same time frame as the statewide plan, few Local PDM Plans are completed. Incorporation of the local vulnerabilities and potential losses is limited at this time and will need to be completed in an updated version of this document.

As of August 18, 2004, the Federal Emergency Management Agency had approved only six Local Hazard Mitigation Plans from Montana. Where available, hazard information from these six plans has been included herein. The hazard information from the county plans provides specific examples of hazards that are profiled for the entire state. The vulnerability assessments conducted for the Statewide Hazard Assessment tends to correlate well with the approved Local Plans. After additional plans are approved, the Statewide Hazard Assessment will be updated with more complete hazard information and detailed vulnerability assessments.

3.1.2.5 Assessing Vulnerability and Potential Losses

Methodologies for assessing hazard vulnerability vary depending upon the hazard, the type of losses that can be incurred, and available data. For some hazards, models have been developed to assess the potential vulnerability and calculate losses. For others, the vulnerability is qualitative and potential losses can only be assessed in a very general nature. The vulnerability assessment requires using data that is specific to a hazard but is general enough to address the entire state. In many cases, there are very specific data that may give an accurate assessment of losses within a specific jurisdiction or region of the state, but if the data cannot be applied statewide, it tends to skew results, potentially ignoring vulnerabilities in other portions of the state that have not been studied in detail.

The methods used in this Hazard Assessment represent the best readily-available data that can be used statewide. **Table 3.1.2-1** describes the methods used to assess vulnerability and losses to State-owned facilities.

Table 3.1.2-1 Vulnerability Assessment Methods

Hazard	Vulnerability Assessment Methods
Earthquake	HAZUS Earthquake Model Level 1 Analysis Using Annualized Loss Estimate Methods by county. If annualized losses exceed \$500,000, the county is considered to be highly vulnerable to earthquakes.
Flooding	Sum of Flood Insurance Coverage by county. If total county-wide policy coverage exceeds \$15M, the county is considered to be highly vulnerable to flooding.
Hazardous Material Incidents	A matrix analysis using the frequency of past hazardous material releases, the number of large industrial facilities that generate wastes, and the miles of rail and highway in the county. Counties with a composite hazardous material index of 30 or greater are considered highly vulnerable to hazardous material incidents.
Landslide	Generally analyzed, insufficient statewide data exists
Terrorism and Violence	Generally analyzed
Volcanic Eruptions	Counties located adjacent to Yellowstone Park are considered highly-vulnerable to impacts from volcanic eruptions, mudflows, and ashfall.
Winter Storms and Avalanches	Statewide impacts; Entire state is highly vulnerable to winter storms.
Drought and Effects of Drought	Assessment by county was based on percent farm income compared to total county income. Counties with more than 20% of total county-wide income from agricultural sources are considered highly vulnerable to drought.
Severe Thunderstorms, Hail, Wind and Tornadoes	A matrix identifying the frequency of tornadoes, extreme wind, and hail events was compiled to determine the counties with greatest occurrence and damage. Counties with a matrix score over 200 were considered highly vulnerable to damage from tornadoes, extreme wind and hail events.
Wildland and Rangeland Fires	Condition class assessment completed by USFS mapped areas where fire suppression and land uses have increased fuels and changed normal fire regimes. Counties with greater than 40% of land in Condition Class II and III were considered highly vulnerable.

Potential losses were only analyzed at the state level and methods for assessing potential losses varied between hazards. The hazard assessment identifies the exposure in structure value and content value for State-owned facilities. Exposure was evaluated as being either direct or indirect. Direct exposure includes those facilities that are located in hazard zones, such as floodplains or landslide areas. Indirect exposure includes those facilities that are located in counties which are determined to be highly vulnerable.

3.1.3 Profile Review

Each hazard profile was subject to a thorough review process directed and managed by the State of Montana, Department of Military Affairs, Disaster and Emergency Services Division (DES). DES Staff, as well as members of the Advisory Group and Hazard Technical Groups, read and provided comments on preliminary drafts and interim drafts of the profiles. The purpose of the expert review was to ensure the accuracy and currency of information presented, to validate the criteria used to identify local jurisdictions most vulnerable particular hazards, and to ensure conformity to Federal requirements for this plan.

3.1.4 Data Limitations

As stated above, the hazard profiles are based on a wide range of information used to describe each hazard and its potential impacts. The profiles help determine jurisdictions most vulnerable to each hazard. The depth of knowledge about the state's major hazards varies greatly. Ongoing research expands the scientific understanding for many of the hazards every year. Individual hazard profiles indicate areas where research is ongoing, if known, and describe any limitations of information or data used in the development of the profile.

Each hazard profile describes the data (and sources) used to determine which jurisdictions are most vulnerable to each hazard. Data limitations, such as lack of spatial data (geocode or latitude-longitude) information on State buildings, are also discussed within each hazard profile.

3.1.5 Qualitative Hazard Assessment Summary

As shown in **Table 3.1.5-2**, the Stakeholders Group determined, based on the current hazard assessment results, that there are six hazard categories the state should be most concerned about:

- Earthquakes
- Flooding
- Winter Storms and Avalanche
- Drought and Effects of Drought
- Severe Thunderstorms, Hail, Wind and Tornadoes
- Wildland and Rangeland Fires

In ranking the hazards, the team examined six consequences of hazard events: potential to damage structures, potential for deaths, potential for injury, potential for economic impact, potential damage to environment, and potential to occur (**Table 3.1.5-1**). Each consequence was ranked from "low" (generating a score of 1), to "high" (generating a score of 3). In applying the damage measures, the assessment assumed the hazard was severe enough to be considered eligible for Federal assistance of some form.

The hazards with the highest total scores were considered the hazards of greatest concern for the state. **Table 3.1.5-2** shows the ranking of the ten hazard categories, with the priority hazards scoring highest.

Table 3.1.5-1 Qualitative Hazard Assessment Measures

Hazard	High	Moderate	Low
Potential to Damage Structures	Widespread, Severe Damage	Localized Severe Damage	Minor Damage
Potential for Deaths	Greater than 10	1-10	No deaths
Potential for Injury	Greater than 50	10-50	Less than 10
Potential for Economic Impact	Extended Widespread	Temporary Widespread	Temporary Localized
Potential Damage to Environment	Widespread, Severe	Localized, Severe	Minimal
Potential to Occur	20 Years or Less	20-100 Years	100 Years or Greater

Table 3.1.5-2 Qualitative Hazard Assessment Summary for Montana

Hazard²	Structure Damage	Potential for Death	Potential for Injury	Economic Impact	Damage to Environment	Potential to Occur	Total¹
<i>Wildland and Rangeland Fires</i>	moderate	high	high	high	high	high	17
<i>Earthquake</i>	high	high	high	high	moderate	low	15
<i>Flooding</i>	moderate	moderate	moderate	high	low	moderate	12
<i>Winter Storms and Avalanche</i>	moderate	moderate	moderate	moderate	low	high	12
<i>Severe Thunderstorms, Hail, Wind & Tornadoes</i>	moderate	moderate	moderate	high	low	high	11
<i>Drought and Effects of Drought</i>	low	low	low	high	moderate	high	10
Hazardous Material Incidents	low	low	moderate	low	moderate	low	8
Landslides	low	low	low	moderate	moderate	low	8
Volcanic Eruptions	low	low	low	moderate	moderate	low	8
Terrorism and Violence	low	low	low	moderate	low	low	7

¹Total value derived by assigning 3 for high, 2 for moderate, and 1 for low.

²Top 6 hazard categories in bold italics.

3.2 INVENTORY OF ASSETS and POPULATION

Hazards have the potential to impact the state by numerous means. Hazards can increase the risk of death or injury to residents and visitors. Hazards can damage the built environment and the State's investment in public office buildings, colleges, hospitals, and prisons. Damages from hazards can interrupt the State's infrastructure, including highways, telecommunications, power distribution systems, conveyance of water, and collection of wastewater. Disasters caused by hazards can also adversely affect the State economy. The intent of this section is to describe these assets, and where possible, assign potential dollar values to them.

The inventory first defines State building assets which include a complete inventory of State-owned buildings and leased buildings, their content values, and real property. The inventory includes facilities that, if damaged during a disaster, could affect the ability to respond and protect the population. They include:

- Essential Facilities (hospitals, police, fire, and military facilities),
- Transportation Systems (railroad, highways, and airports),
- Lifeline Utility Systems (petroleum pipelines, natural gas pipelines and electrical transmission facilities),
- High Potential Loss Facilities (dams, research facilities, and universities), and
- Major Hazardous Material Facilities (chemical plants, petroleum terminals, and frequently-traveled transportation routes).

The inventory includes a county by county assessment of personal per capita annual income and estimated economic activity by county. The population is described, including its characteristics and distribution throughout the state.

3.2.1 State-Owned Buildings and Property

3.2.1.1 State Buildings

The State of Montana owns approximately 4,500 buildings with a total estimated value of \$2.5 billion. Buildings are located in every county in the state with government complexes concentrated in Helena and higher education complexes in Missoula, Bozeman, Butte, Billings, Havre, and Dillon.



Picture 2.1-1 DNRC offices in Helena.

Source: MDNRC, 2004a.

Table 3.2.1-1 summarizes the buildings by department and includes square footage, building value, building content value, and special content value. The University System has the largest complex of buildings (approximately 1,200), with an estimated value of \$1.5 billion including content value. The University System buildings represent 54% of the total square footage of State-owned buildings, but make up 64% of the total value. That difference may be partially attributable to the special content value assigned to books and specialized research equipment. The Department of Administration has the next largest group of buildings, primarily associated with the Capitol Complex. The 53 Administration buildings have an estimated total value of \$229 million, including the \$72 million Capitol building.

Table 3.2.1-1 Content & Structure Value by State Agency

Agency	Square ft	No. of Buildings	Building Structure Value	Building Content Value	Special Content Value	Total Value
Auditor's Office	17,500	1	\$0	\$572,600	\$45,200	\$617,800
Department of Administration	1,442,101	53	\$175,076,082	\$49,788,127	\$14,983,794	\$239,848,003
Department of Agriculture	40,966	18	\$437,816	\$3,056,468	\$2,300	\$3,496,584
Department of Commerce	374,467	689	\$26,855,049	\$3,227,442	\$532,000	\$30,614,491
Department of Corrections	1,245,670	181	\$108,475,216	\$19,390,919	\$1,180,000	\$129,046,135
Department of Environmental Quality	430,719	28	\$3,044,577	\$2,310,363	\$453,500	\$5,808,440
Department of Fish, Wildlife And Parks	713,362	789	\$37,213,212	\$8,331,721	\$122,873	\$45,667,806
Department of Justice	247,288	75	\$6,086,571	\$8,565,831	\$2,540,400	\$17,192,802
Department of Labor & Industry	200,843	37	\$7,584,271	\$5,927,555	\$1,314,826	\$14,826,652
Department of Livestock	7,990	2	\$0	\$531,004	\$33,000	\$564,004
Department of Military Affairs	569,425	85	\$43,985,646	\$15,510,628	\$0	\$59,496,274
Department of Natural Resources	425,847	218	\$25,245,628	\$15,461,100	\$1,134,790	\$41,841,518
Department of Revenue	197,729	59	\$3,839,140	\$3,864,134	\$10,294,143	\$17,997,417
Department of Transportation	1,974,186	921	\$105,272,013	\$26,448,690	\$3,329,300	\$135,050,003
Governor's Office	38,875	7	\$0	\$1,097,427	\$1,564,200	\$2,661,627
Historical Society	206,506	22	\$3,606,535	\$1,861,028	\$7,000	\$5,474,563
Office of Public Instruction	33,859	46	\$41,645	\$879,258	\$1,134,500	\$2,055,403
Public Health & Human Services	1,619,251	202	\$89,858,961	\$35,255,328	\$4,738,851	\$129,853,140
Public Service Regulation	15,600	1	\$0	\$421,200	\$26,319	\$447,519
State Board of Education	166,399	17	\$15,426,529	\$2,192,183	\$790,000	\$18,408,712
State Fund	85,758	6	\$6,668,421	\$3,900,449	\$420,000	\$10,988,870
Supreme Court – Judiciary	12,189	2	\$0	\$398,824	\$74,500	\$473,324
University System	12,274,698	1218	\$1,097,538,238	\$286,672,316	\$264,508,889	\$1,648,719,443
TOTALS			\$1,756,255,550	\$495,664,595	\$309,230,385	\$2,561,150,530

Source: Property Casualty Insurance Information System (PCIIS) maintained by the Montana Department of Administration's Risk Management and Tort Defense Division (April 16, 2004).

Note: Those structure values of \$0 represent leased buildings, not state-owned.

The Property Casualty Insurance Information System (PCIIS) database of the Montana Risk Management and Tort Defense Division assigns building locations by address and city, but digital parcel location attributes are not included in the database. Without parcel geo-codes or latitude/longitude data, the individual buildings cannot be precisely located within hazard zones, limiting the ability to make quantitative assessments of building exposures to a particular hazard. However, an inventory of State buildings in areas with a high exposure to a particular hazard can provide a qualitative indication of their vulnerability. The State building complexes and large facilities, with structure values over \$10 million, are summarized in **Table 3.2.1-2**.

Table 3.2.1-2 Major State Buildings/Complexes

Dept	Complex/Building	Location	Building Structure Value	Aggregate Content Value	Employees
Administration					
	Capitol Complex	Helena	\$175,076,082	\$63,986,615	2,417
Department of Corrections					
	Women's Prison Complex	Billings	\$18,127,640	\$1,654,600	67
	Pine Hills School	Miles City	\$18,643,804	\$3,043,243	142
	State Prison	Deer Lodge	\$48,920,270	\$6,159,223	315
Natural Resource & Conservation					
	Toston Dam Power House	Toston	\$10,226,673	\$7,416,00	1
Transportation					
	Helena Headquarters Complex	Helena	\$17,973,554	\$5,602,643	600
Health & Human Services					
	Montana Developmental Center	Boulder	\$16,281,527	\$4,765,885	231
	State Hospital	Warm Spr.	\$46,127,226	\$7,623,973	424
Board of Education					
	School for the Deaf & Blind	Great Falls	\$15,426,529	\$2,890,170	82
University System					
	College of Technology-Helena	Helena	\$12,016,863	\$4,706,736	84
	Montana State Univ-Billings	Billings	\$139,194,086	\$55,230,324	626
	Montana State Univ-Bozeman	Bozeman	\$392,015,457	\$270,444,761	2,748
	Montana State Univ-Northern	Havre	\$47,104,007	\$26,174,924	242
	Montana Tech	Butte	\$66,562,811	\$28,874,852	183
	College of Technology-Great Falls	Great Falls	\$13,378,583	\$5,493,260	121
	University of Montana-Missoula	Missoula	\$376,653,840	\$138,389,570	2,853
	University of Montana-Western	Dillon	\$39,522,295	\$13,401,575	589

Source: Property Casualty Insurance Information System (PCIIS) maintained by the Montana Department of Administration's Risk Management and Tort Defense Division (April 16, 2004).

3.2.1.2 State Real Property

The State of Montana owns real property scattered throughout the state, including State highways, government office property, land in waterways, and School Trust property. The most significant land holdings are classified as School Trust property. A summary of the State real property, exclusive of highways and waterways, is shown in **Table 3.2.1-3**.

The Montana Department of Natural Resources and Conservation (MDNRC) administers all School Trust land granted to the State through the Federal Enabling Act of 1899. This act provided over 5 million acres to the State to be managed for common school support. The trust beneficiaries include the K-12 public schools, institutions for higher education, Pine Hills Youth Correctional Facility, Montana School for the Deaf and Blind, and Montana

Veteran's Home. The current surface acreage is less than the original grant due to land exchanges, incorporation by tribal reservations, and lands deeded before the Enabling Act.

Table 3.2.1-3 Montana State Trust Land Acreage. Source: MDNRC, 2004a.

Land Grant	Original Acreage	Current Surface Acreage	Current Mineral Acreage
Common School	5,188,000	4,633,474	5,601,046
Other Land Grants			
The University of Montana	46,720	18,556	33,754
Montana State University- Morrill Grant	90,000	63,456	76,960
Montana State University- Second Grant	50,000	31,424	47,077
Montana Tech of The University of Montana	100,000	59,440	86,267
State Normal School	100,000	63,455	83,737
School for the Deaf and Blind	50,000	36,461	41,171
State Reform School	50,000	68,271	78,125
Veterans Home	0	1,276	1,276
Public Buildings	182,000	186,976	228,270
TOTALS	5,856,720	5,162,789	6,277,683

3.2.2 Critical Facilities

3.2.2.1 Essential Facilities

Essential Facilities are those that are critical to functioning in the event of a disaster and include: hospital and trauma care centers, police and fire stations, emergency operations centers, and military facilities. Hospitals and trauma centers provide emergency care to the injured. Functional loss due to hazard damage can severely impact the ability to provide immediate care and reduce loss of life during a disaster event. The American Hospital Association (AHA) classifies medical facilities by the number of beds. Large medical facilities are those that have greater than 150 beds. Medium hospitals are those that have 50-150 beds. In Montana, there are 7 large hospitals, and of those, there are 4 Level II Trauma Centers recognized by the American College of Surgeons (**Table 3.2.2-1**). There are 26 medium hospitals throughout Montana. **Figure 3.2.2-1** identifies the large and medium hospitals, Type II trauma centers, and State and federal emergency operations centers. Note that the data used to display the hospitals was obtained from FEMA's HAZUS-MH database. This database is known to have errors, and therefore, the hospital locations may be inaccurate and other large and medium hospitals may be missing.

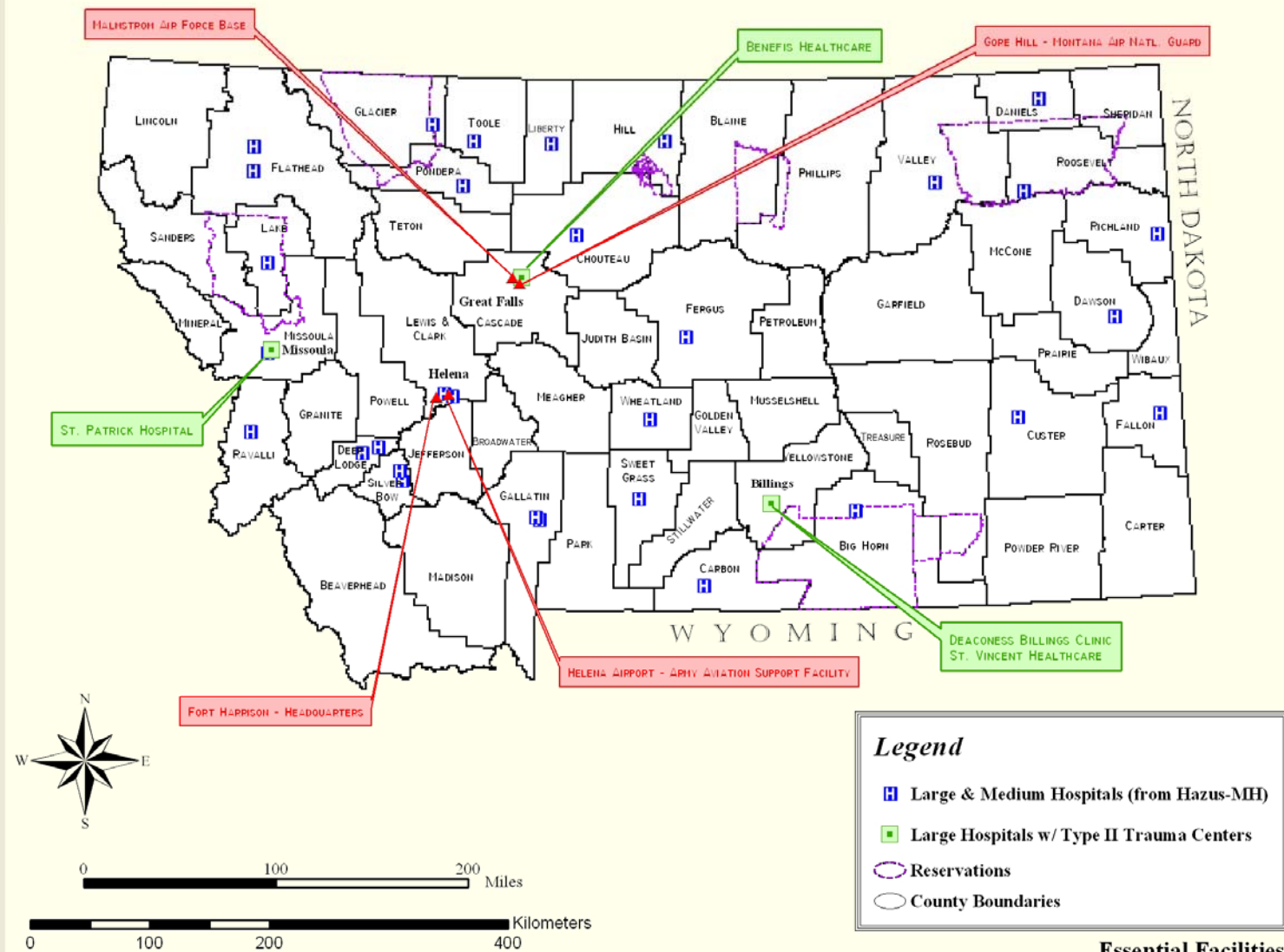
Figure 3.2.2-1 Essential Facilities

Table 3.2.2-1 Major Hospitals and Trauma Centers in Montana. Source: AHA, 2004.

Hospital Name	Address	City	Trauma	Number of Beds
Benefis Healthcare	1101 26th Street South	Great Falls	Level II	467
Deaconess Billings Clinic	2800 10th Avenue North	Billings	Level II	305
St Vincent Healthcare	1233 North 30th Street	Billings	Level II	278
Northern Montana Hospital	30 13th Street	Havre		212
St Patrick Hospital	500 West Broadway	Missoula	Level II	190
Montana State Hospital		Warm Springs		174
Holy Rosary Health Center	2600 Wilson Street	Miles City		151

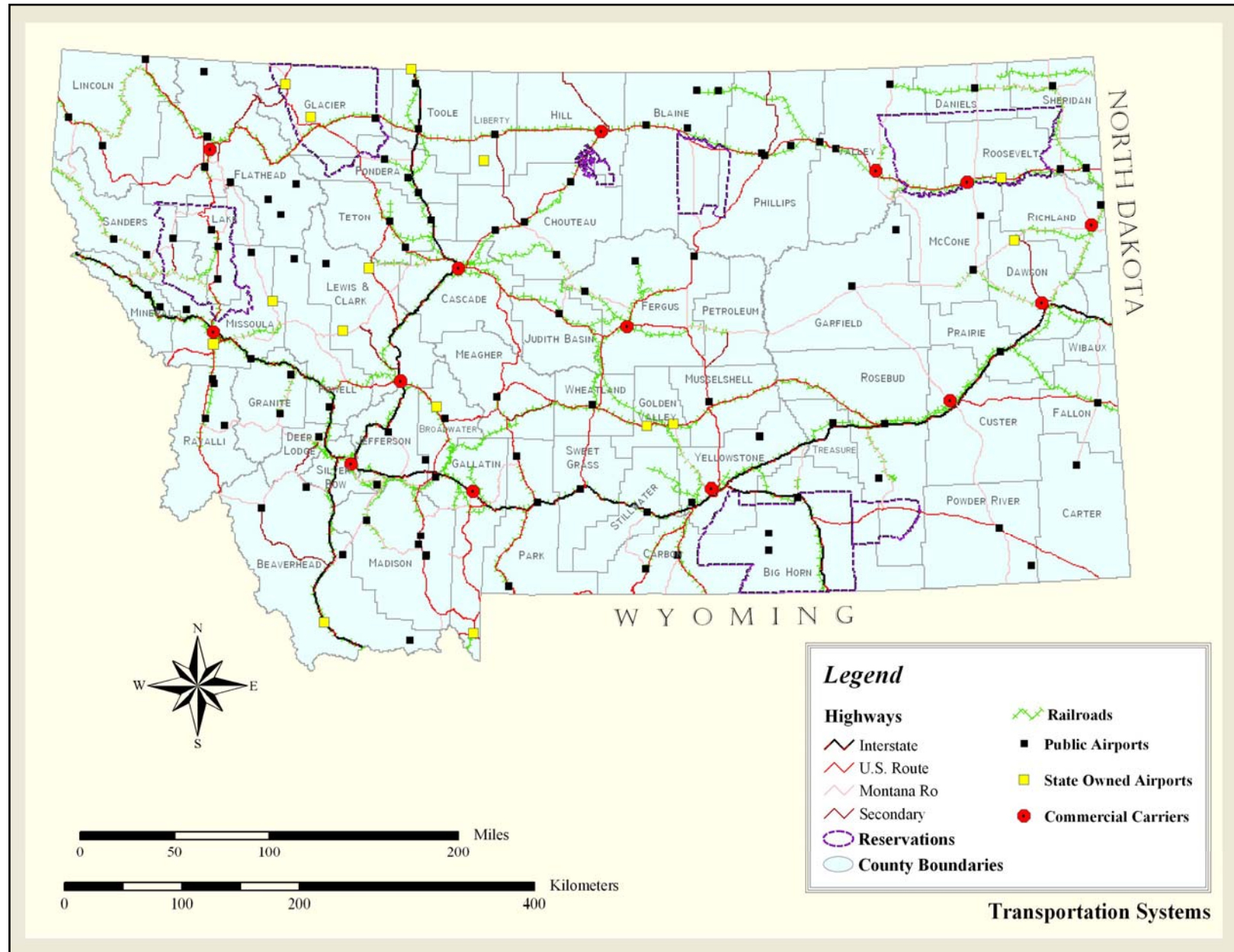
Emergency operations centers are essential for coordinating and conducting disaster response. They include local police and fire stations, local and State emergency operations centers, National Guard headquarters and operations, and Federal military facilities. Loss of function of these centers may adversely affect communication and direct response activities. Other facilities, such as schools and armories, are used for emergency shelters to house displaced populations. State and Federal emergency operations centers are shown below in **Table 3.2.2-2**.

Table 3.2.2-2 Emergency Operations Centers

Name	Address	City	Function
Montana Army National Guard	Fort Harrison	Helena	National Guard support for disaster response
Army Aviation Support Facility	Helena Airport	Helena	Helicopter support to the Army National Guard
Montana Air National Guard	Malmstrom Air Force Base	Great Falls	Personnel and air support for natural disasters. Civil engineering support for base and contingency operations.
Air Force ICBM Operations Groups	Malmstrom Air Force Base	Great Falls	Launch, monitoring, and security for the Intercontinental Ballistic Missile complex
Montana Highway Patrol	Fort Harrison	Helena	Law enforcement support for disaster response
Montana Disaster & Emergency Services Division	Fort Harrison	Helena	Coordination, Logistics, and Communications for disaster response

3.2.2.2 Transportation Systems

Transportation Systems are critical for the movement of the population, mobilization of resources to respond to disasters, and the ability to import resources to restore normality to the population. There are approximately 70,000 miles of public roads and highways in Montana. Approximately 11,000 miles of highway and 2,100 bridges are maintained by the Montana Department of Transportation (MDT). The Federal interstate system consists of about 1,200 miles within Montana. **Figure 3.2.2-2** shows the distribution of State and Federal highways throughout the state.

Figure 3.2.2-2 Transportation Systems

Approximately 6,150 miles of rail lines traverse Montana. The major rail system operators are Burlington Northern and Montana Rail Link, respectively maintaining 3,900 miles and 1,540 miles of track. Amtrak has twelve passenger stations, all located along the section of northern Montana termed the High Line (area flanked by Highway 2) in northern Montana.

Montana has 15 State-owned airports, 118 public-use airports, and 350 private-use airports. Of the 118 public-use airports, the following cities are serviced by regional or commercial carriers: Billings, Bozeman, Butte, Glasgow, Glendive, Great Falls, Havre, Helena, Kalispell, Lewistown, Miles City, Missoula, Sidney, and Wolf Point. **Figure 3.2.2-2** shows the location of State-owned and commercial carrier public-use airports.

3.2.2.3 Utility Systems

The most essential utility systems in Montana include major electrical generating facilities, transmission networks, natural gas pipelines and petroleum pipelines. These facilities maintain light, heat, and energy resources for Montana and much of the northwestern United States. The location of these facilities in hazard areas increases our vulnerability to service disruption and shortages of energy resources. Other critical utility systems, such as potable water supply and wastewater facilities, are owned and operated at the local level.

Montana annually generates about 17 billion kilowatt hours of electricity, primarily through coal-fired plants and hydroelectric facilities (EIA, 1999). Major power generating facilities, exclusive of hydroelectric facilities, are shown in **Table 3.2.2-3**.

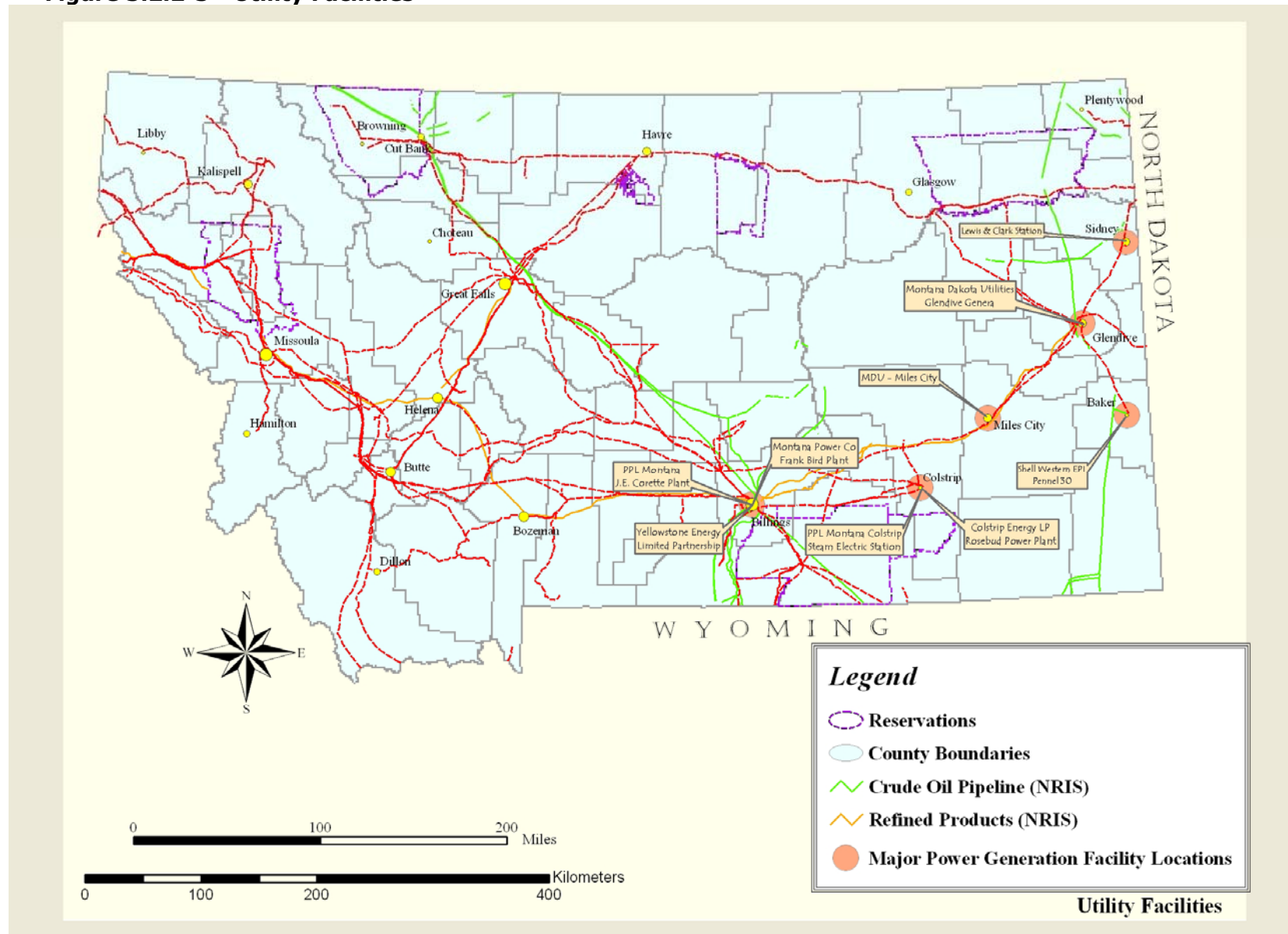
Table 3.2.2-3 Major Power Generation Facilities in Montana. Source: EIA, 1999

Name	Location
Colstrip Energy L P Rosebud Power Plant	Colstrip
Lewis & Clark Station	Sidney
MDU - Miles City	Miles City
Montana Dakota Utilities Glendive Genera	Glendive
Montana Power Co Frank Bird Plant	Billings
PP&L Montana Colstrip Steam Electric Station	Colstrip
PPL Montana - J.E. Corette Plant	Billings
Shell Western EPI Pennel 30	Baker
Yellowstone Energy Limited Partnership	Billings

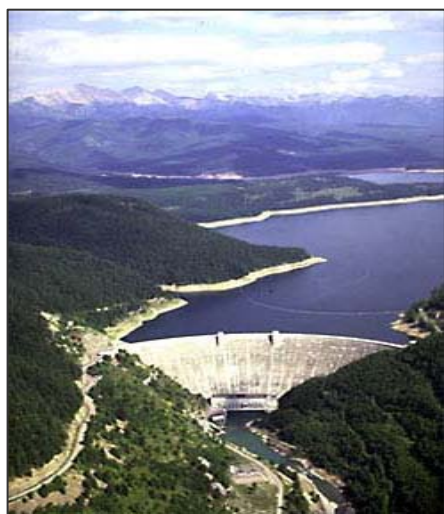
The locations of major electrical transmission lines, natural gas pipelines and petroleum product pipelines are shown on **Figure 3.2.2-3**.

3.2.2.4 High Potential Loss Facilities

High Potential Loss Facilities (HPLF) are those likely to cause heavy losses if significantly damaged. For this evaluation, HPLF include dams, military installations, universities, and research facilities.

Figure 3.2.2-3 Utility Facilities

3.2.2.4.1 Dams



Approximately 2,852 dams are located within the State of Montana (USACE NID, 2004). Of these dams, 171 are "high-hazard dams", indicating they are upstream from populated areas (USACE NID, 2004). Of the high-hazard dams, 32 are over 100 feet high. Of these 32 dams, 14 store more than 100,000 cubic feet of water (**Table 3.2.2-4**).

The county with the most high-capacity, high-hazard dams is Lewis and Clark, which has 3 large dams along the Missouri River and one along the North Fork of the Sun River (**Table 3.2.2-4**). Hungry Horse Dam is the highest dam, at 564 feet. Fort Peck Dam has the largest storage capacity, at 19 million acre-feet.

Picture 2.2-1 Hungry Horse Dam along the South Fork of the Flathead River. Source: USDI BOR, 2004.

Table 3.2.2-4 Montana High Hazard Dams, 100 feet high or more, with more than 100,000 of storage. Source: USACE NID, 2004.

Dam Name	Other Dam Name	River	Nearest City	NID Height (ft)	NID Storage (acre-ft)	Drainage Area (sq mi)	County	Owner Name
Hungry Horse	Hungry Horse Res	South Fork Flathead River	Hungry Horse	564	3,588,000	1640	Flathead	USDI BOR
Yellowtail	Bighorn Lake	Bighorn River	Saint Xavier	525	1,427,340	19,650	Big Horn	USDI BOR
Libby	Lake Koocanusa	Kootenai River	Libby	422	6,027,000	8985	Lincoln	USACE
Fort Peck Dam	Fort Peck Lake	Missouri River	Nashua	256	19,100,000	57,725	McCone, Garfield, Valley	CENWO
Canyon Ferry	Canyon Ferry Lake	Missouri River	Canyon Ferry	225	2,051,000	15,860	Lewis And Clark	USDI BOR
Tiber	Tiber Res	Marias River	Loma	206	1,424,478	4923	Liberty	USDI BOR
Gibson	Gibson Res, Beaver Creek	North Fork Sun River	Simms	199	121,981	575	Teton, Lewis And Clark	USDI BOR
Kerr		Flathead River	Agency	194	1,791,000	7096	Lake	PPL & Salish-Kootenai Tribe
Noxon Rapids		Clark Fork, Pend Oreille River	Noxon	179	400,000	21,800	Sanders	Washington Water Pwr Co
Clark Canyon	Clark Canyon	Beaverhead River	Dillon	148	328,979	1550	Beaver-head	USDI BOR
Hauser Dam		Missouri River	Craig	125	139,890	16,876	Lewis And Clark	PPL
Holter Dam		Missouri River	Craig	124	306,000	17,150	Lewis And Clark	PPL
Fresno	Fresno Res	Milk River	Havre	111	229,288	2828	Hall	USDI BOR
Lake Sherburne		Swiftcurrent Creek	Babb	109	110,679		Glacier	USDI BOR

3.2.2.4.2 Military Facilities

Montana has a large military complex in Great Falls, which includes the 120th Fighter Wing of the Montana Air National Guard and the United States Air Force 819th Red Horse Squadron. In addition, the Montana Army National Guard has facilities in the following cities: Anaconda, Belgrade, Billings, Bozeman, Butte, Chinook, Culbertson, Dillon, Glasgow, Glendive, Great Falls, Hamilton, Harlowton, Havre, Helena, Kalispell, Lewistown, Livingston, Malta, Miles City, Missoula, and Sidney.

Montana is the home of 200 Minuteman Inter-Continental Ballistic Missiles (ICBM), which are overseen by Malmstrom Air Force Base in Great Falls. The Minuteman silos are scattered over various locations in north-central and north-eastern Montana. The missile silos are over 40 years old, and have been updated with new warheads several times. Under the Start II Treaty, the Air Force will "deMIRV" the remaining Minuteman III Missiles now in service, changing them from three-warhead to single-warhead weapons, which are expected to remain operational in the American West until 2020 (Air Force Magazine, 2001).

3.2.2.4.3 Colleges and Universities

Colleges and universities are considered potential high loss facilities for several reasons. First, almost 40,000 students attend colleges and universities in Montana. The higher education facilities and surrounding area house many of these students during the academic year and pose specific disaster concerns. In addition, these facilities often house expensive research equipment, much of it owned by the State. All of Montana's colleges and universities, not just those that are state-owned, are listed in **Table 3.2.2-5**.

Table 3.2.2-5 Universities and Colleges in Montana.

Source: Montana, 2004.

Community Colleges
▪ Dawson Community College
▪ Flathead Valley Community College
▪ Miles Community College
Technical Colleges
▪ Helena College of Technology of The University of Montana
▪ Montana Tech College of Technology of The University of Montana
▪ Missoula College of Technology of The University of Montana
▪ Montana State University Billings College of Technology
▪ Montana State University College of Technology Great Falls
State Colleges and Universities
▪ The University of Montana
▪ Montana Tech of The University of Montana
▪ The University of Montana - Western
▪ Montana State University Bozeman
▪ Montana State University-Billings
▪ Montana State University-Northern
Tribal Colleges
▪ Blackfeet Community College
▪ Chief Dull Knife College
▪ Fort Belknap College
▪ Fort Peck Community College
▪ Little Big Horn College
▪ Salish Kootenai College
▪ Stone Child College
Independent Colleges
▪ Carroll College
▪ University of Great Falls
▪ Rocky Mountain College

3.2.2.4.4 Research Facilities

The majority of university research in Montana, on a wide variety of topics, is conducted at the two universities: the University of Montana in Missoula and Montana State University in Bozeman. In addition, several Federal agencies conduct research, including the US Department of Agriculture (Agricultural Research Service, Forest Service, Natural Resource Conservation Service) and US Department of Interior (Bureau of Land Management, Fish, Wildlife & Parks Service, and the National Park Service).

University and Federal agencies often establish long-term working relationships at fixed facilities scattered around the state. For example, The Fort Keogh Livestock and Range Research Laboratory, operated by the U.S. Department of Agriculture's (USDA) Agricultural Research Service (ARS), covers 55,000 acres of native rangeland, planted dry land, irrigated pasture and irrigated cropland near Miles City. ARS, the USDA's primary scientific research agency, operates the facility in cooperation with Montana State University's Agricultural Experiment Station. Fort Keogh researchers focus on beef cattle genetics and reproductive physiology, range animal nutrition, and range ecology and management. A USDA facility since 1924, Fort Keogh has more than 40 permanent employees, as well as 25 working horses and a herd of about 1,500 cows (FLCTT, 2004).

Two bio-medical research laboratories are located in Montana: Rocky Mountain Labs and the McLaughlin Research Institute (MRI). The McLaughlin Research Institute is an independent, non-profit research organization in Great Falls, Montana. Research at the institute focuses on understanding the genetic control of normal development and disease susceptibility using the mouse as a model system (MRI, 2004).

Rocky Mountain Laboratories (RML) in Hamilton, Montana, a Biosafety Level 4 laboratory, studies infectious microbes that cause disease in humans and animals. RML is part of the National Institute of Allergy and Infectious Diseases (NIAID), a component of the National Institutes of Health (NIH). NIAID conducts and supports research that strives to understand, treat, and ultimately prevent the myriad infectious, immunologic, and allergic diseases that threaten hundreds of millions of people worldwide (RML, 2004).

3.2.2.5 Hazardous Material Facilities

Hazardous Material Facilities may or may not be critical for emergency operations; however, these facilities are critical based on their potential to harm the population and the environment. Through intentional or accidental release, the population is at risk should an event result in the uncontrolled release of hazardous substances.

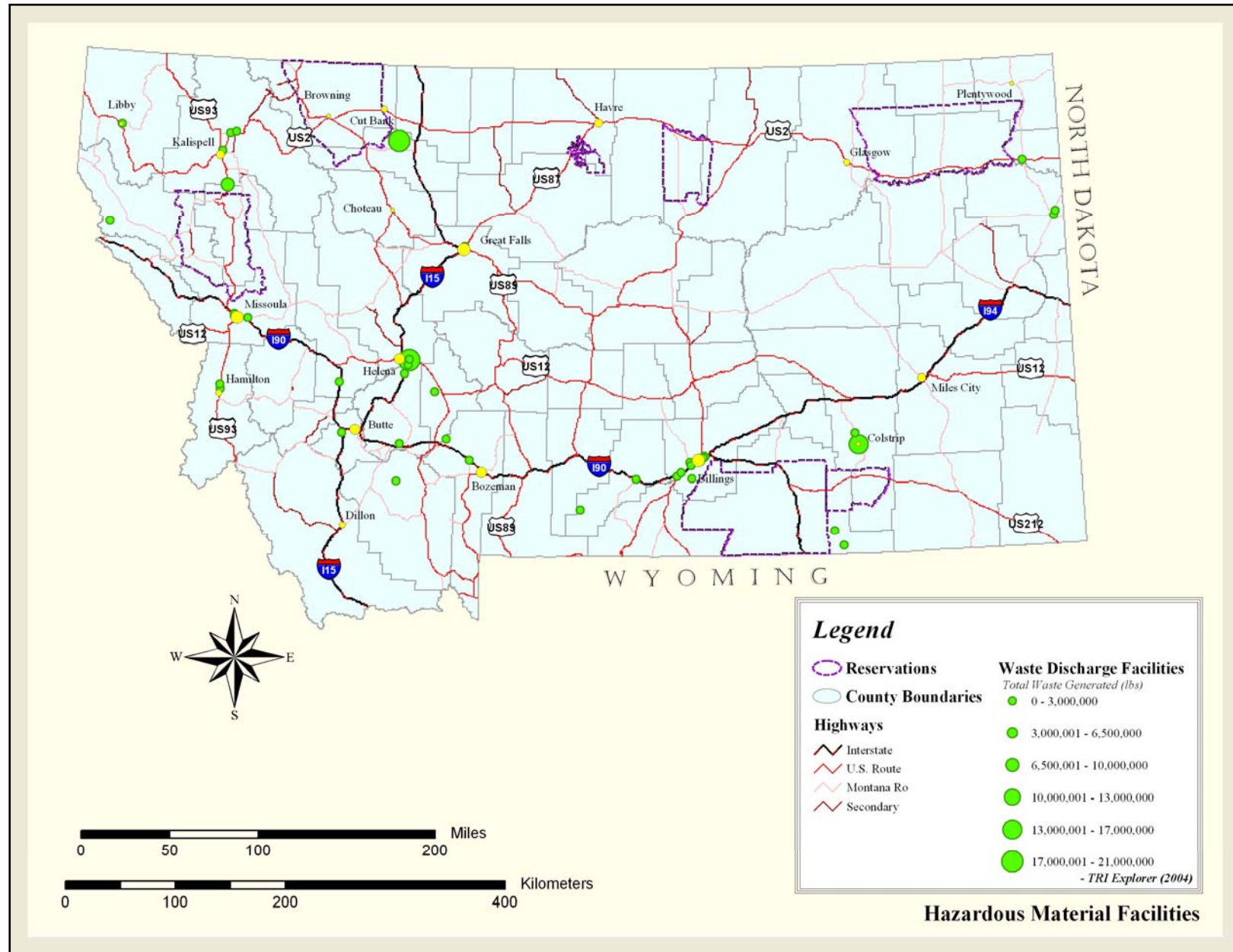
In Montana, approximately 1,190 miles of Federal interstate highway are considered major hazardous material transportation routes. There are over 5,000 miles of railroad along which hazardous materials are transported. In addition, 2,400 miles of pipelines transport natural gas, crude oil, and refined petroleum products. These transportation routes are shown on **Figure 3.2.2-4**.

The list of hazardous material facilities was generated by querying the Toxics Release Inventory (TRI) database that is publicly available through the US Environmental Protection Agency (EPA, 2004b). The database contains information on specific toxic chemical releases and other waste management activities reported annually by certain covered industry groups and Federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), which requires facilities to use their best readily-available data to calculate their releases and waste management estimates. If

facilities do not have actual monitoring data, submitted values are derived from various estimation techniques. Forty-eight facilities are included on the TRI database and their locations are shown on **Figure 3.2.2-4**. The 10 facilities with the greatest volume of waste emissions are shown in **Table 3.2.2-6**.

Table 3.2.2-6 Top Ten Facilities for Waste Emissions. Source: EPA, 2004b.

Name	City	On- and off-Site Releases (lbs)
Asarco Smelter	East Helena	22,270,720
Montana Tunnels Mining	Jefferson City	20,946,372
Colstrip Steam Electric Station	Colstrip	11,360,388
Golden Sunlight Mines	Whitehall	2,602,779
Stone Container Corp	Missoula	1,508,089
Stillwater Mining Company	Stillwater	906,760
Colstrip Energy Rosebud Power Plant	Colstrip	756,889
Plum Creek MDF	Columbia Falls	697,550
Montola Growers	Culbertson	678,087
Conoco Billings Refinery	Billings	236,772

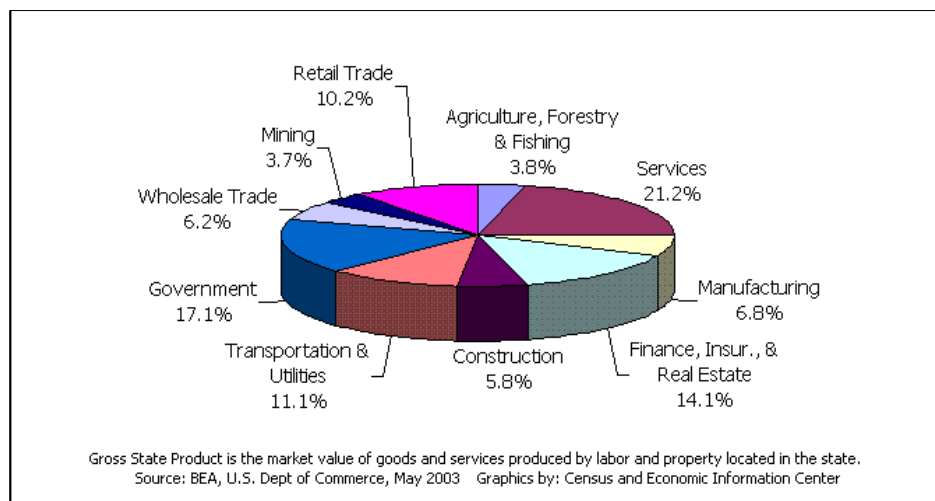
Figure 3.2.2-4 Hazardous Material Facilities

3.2.3 Montana Economy

Montana's economy was built on natural resource extraction industries: agriculture, forestry, and mining. Over the last 25 years Montana's economy has evolved to be dependent on service, finance/insurance/real estate, and government sectors. These three sectors represent over 50% of the Montana's Gross State Product (GSP), whereas 25 years ago these sectors represented 38%. (USDC BEA, 2003). As a percentage of the GSP, agriculture and mining have been cut in half and manufacturing and construction are two-thirds the percentage they were 25 years ago. The evolution of the economy appears to be continuing in that direction, with less reliance on forestry, farming, mining, and manufacturing and more dependence on the government and service sectors (USDC BEA, 2003).

As of the 2000 Census, Montana contained a civilian labor force of 480,000 people, with a statewide unemployment rate of 4.9 percent. During the 1990s, employment shifted away from traditional, basic industry to retail trade and service-sector jobs (education/health care/real estate/trade/tourism). The labor force currently is split, with 23 percent in basic industries (agriculture/mining/manufacturing) and 77 percent in derivative industries (trade and services). The state's per-capita income in 2000 was \$22,569. Montana is one of only five states in the United States that does not levy a state sales tax.

Figure 3.2.3-1 Gross State Product by Major Industry. Source: USDC BEA, 2003.



3.2.3.1 Personal Income by County

Personal income is the income received by personal production, both from government and business transfer payments, and from government interest (which is treated like a transfer payment). It is calculated as the sum of wage and salary disbursements, other labor income, proprietors' income with inventory valuation and capital consumption adjustments, rental income of persons with capital consumption adjustments, personal dividend income, personal interest income, and transfer payments to persons, less personal contributions for social insurance (USDC BEA, 2004).

This measure of income is calculated as the personal income of the residents of a given area divided by the resident population of the area. In computing per capita personal income,

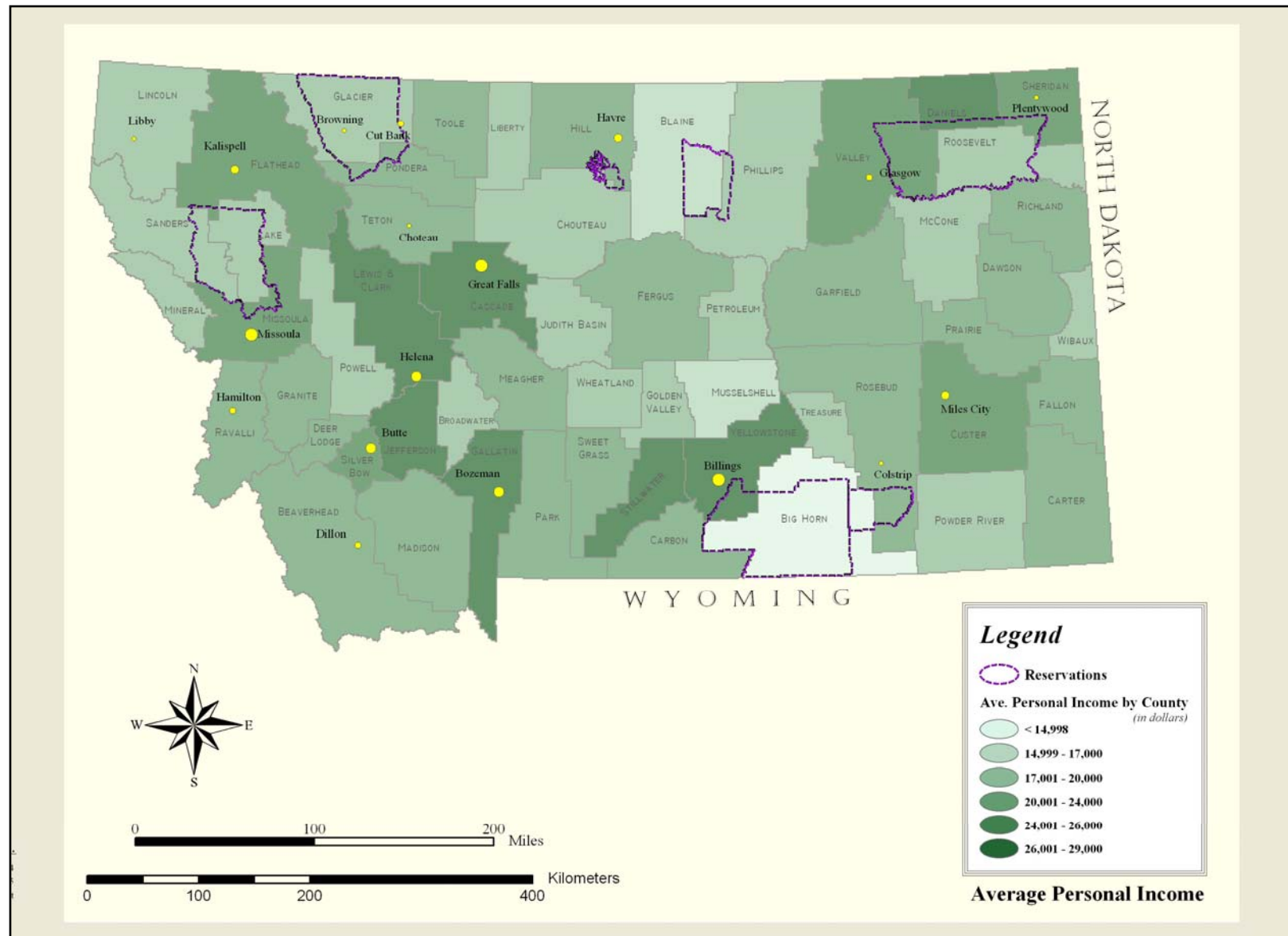
the US Department of Commerce (USDC BED, 2004) uses the Census Bureau's annual midyear population estimates. All state and local area dollar estimates are in current dollars (not adjusted for inflation).

The personal income of Montana has historically been significantly less than the national average. From 1970 to 2000, Montana's per capita personal income dropped from 89% to 76% of the national average. Across the state, there are also significant differences in personal income. **Figure 3.2.3-2** shows the average personal income by county. The counties with higher urban populations typically have higher personal incomes. The principal exceptions are the counties that have had a predominant industrial mining base (**Table 3.2.3-1**).

Table 3.2.3-1 Average Personal Income by Montana County (5 Highest and 5 Lowest). Source: USDC BEA, 2003

Highest Personal income	1997	1998	1999	2000	2001
Stillwater	\$18,975	\$20,661	\$22,011	\$24,721	\$28,564
Yellowstone	\$22,963	\$24,285	\$24,869	\$26,628	\$27,891
Jefferson	\$21,997	\$23,041	\$23,611	\$25,476	\$27,052
Gallatin	\$21,214	\$22,801	\$23,358	\$25,139	\$26,442
Lewis and Clark	\$22,213	\$23,530	\$24,198	\$25,623	\$26,230
Lowest Personal Income	1997	1998	1999	2000	2001
Big Horn	\$12,539	\$13,270	\$13,301	\$15,021	\$14,998
Musselshell	\$14,543	\$14,769	\$14,419	\$15,090	\$16,133
Blaine	\$13,913	\$15,744	\$15,575	\$16,135	\$16,715
Golden Valley	\$14,725	\$16,447	\$15,702	\$16,947	\$17,450
Roosevelt	\$14,897	\$16,467	\$17,254	\$17,664	\$17,786
Montana Average	\$19,920	\$21,225	\$21,621	\$22,961	\$24,044

Figure 3.2.3-2 Average Personal Income



3.2.4 Population

3.2.4.1 Total Population

With 902,195 persons, Montana ranks 44th in total state population in the U.S. (**Table 3.4.2-1**). Montana is ranked 48th amongst other states for population density, with 6.2 persons per square mile, compared to a national average of 79.6 persons per square mile.

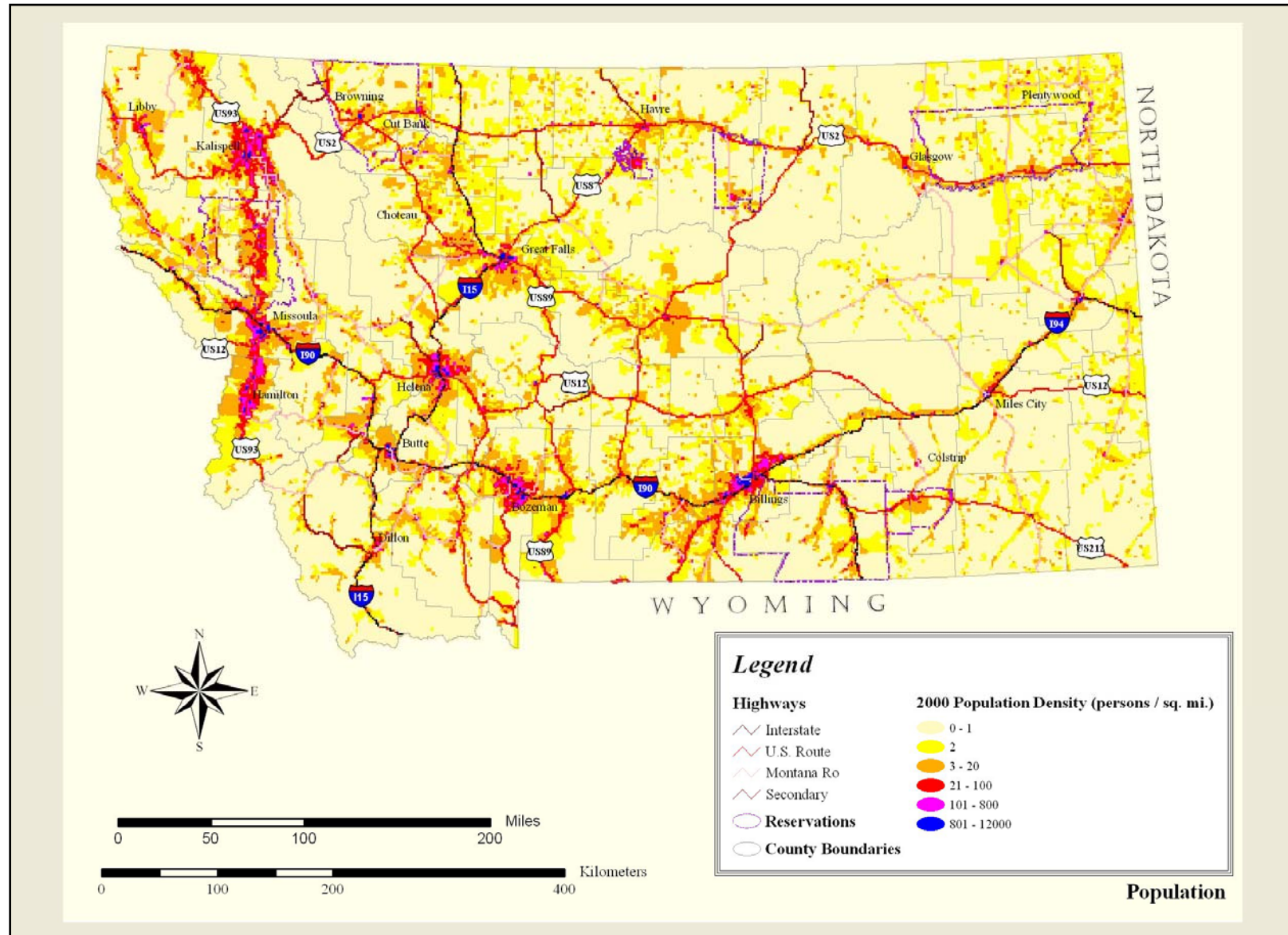
The growth in population varies greatly across the state, with the urban areas and western counties experiencing significant growth and some rural eastern counties with net losses (**Table 3.2.4-2** and **Figure 3.2.4-1**). Ravalli and Gallatin Counties witnessed explosive growth (44.2% and 34.4% respectively), while Garfield County ranked 3,124 of 3,141 counties in the country for growth (19.5% decrease). The state population is expected to increase by 200,000 people by 2025, thus putting the total population over 1 million people (Source: MDPHHS, 1999, 2001).

Table 3.2.4-1 General State Population Statistics. Source: MDPHHS, 2001

Parameter	1980	1990	2000
Census Population	786,690	799,065	902,195
% increase from last census	13.30%	1.60%	12.90%
Minority population		57,954	70,217
% of total state population		7.60%	7.80%
State Median age	28.4	33.8	37.5

Table 3.2.4-2 Counties with the Highest and Lowest Populations.
Source: MDPHHS, 2001.

Counties w/ Highest Population	Forecast July 2003	Census 2000
Yellowstone	133,191	129,352
Missoula	98,616	95,802
Cascade	79,561	80,357
Flathead	79,485	74,471
Gallatin	73,243	67,831
Counties w/ Lowest Population	Forecast July 2003	Census 2000
Petroleum	491	493
Treasure	735	861
Wibaux	977	1,068
Golden Valley	1,047	1,042
Prairie	1,154	1,199
Montana	917,621	902,195

Figure 3.2.4-1 Population

3.2.4.2 Sensitive Populations

3.2.4.2.1 Elderly

The percentage of elderly population (65 and over) in Montana increased from 10.7% to 13.4% between 1980 and 2000 (**Table 3.2.4-3**). This trend is expected to accelerate in the next 20 years, so that by 2025, Montana will experience one of the most dramatic demographic transformations in its history. As the Baby Boom generation (those born between 1946 and 1964) reaches retirement age, the proportion of Montana's population classified as elderly is expected to increase from 13.1 percent in 1995 to 24.5 percent in 2025. Among the 50 states and the District of Columbia, the state was ranked 23rd for the highest proportion of elderly in 1995 and is projected to have the 3rd highest proportion of elderly in 2025 (Source, MDPHHS, 1999, 2001).

Table 3.2.4-3 State Aging Population Statistics. Source: MDPHHS, 2001.

Demographic Parameter	1980	1990	2000
60 and over population eligible for OAA services	119,240	140,813	158,894
% increase of 60 and over from last census	22.7%	18.1%	12.8%
60 and over as a % of total state population	15.2%	17.6%	17.6%
65 or over state population	84,559	106,497	120,949
% increase of 65 and over from last census	23.0%	25.9%	13.6%
65 and over as a % of total state population	10.7%	13.3%	13.4%
85 and over state population	8,837	10,676	15,337
% increase of 85 and over from last census	42.2%	20.8%	43.7%
85 and over as a % of total state population	1.1%	1.3%	1.7%

3.2.4.2.2 School Populations

In Montana, the echo of the Baby Boom peaked at 14,141 births in 1984. The birth rate has declined almost every year since 1984 to 10,800 in 1996. In the past 5 years the birth rate seems to have stabilized to around 10,800 births per year.

The number of school age children (the total number ages 5-18) peaked at 187,568 in 1992, decreased to 172,674 in 2001, and is projected to be 159,700 in 2005. If the birth rate continues at 10,800 per year, the available school age population is expected to level out at 151,200 in 2015. Migration both in and out of the state is expected to be the primary factor affecting the population growth or decrease in the school age population (Carlson, 2001).

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